Replacement Kit
7E Converter
OPTIMUS RAD / RF / C

4512 204 0015.

FILING INSTRUCTIONS

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SERVICE MANUAL
742
UNIT

Replacement Kit
7E Converter
OPTIMUS RAD / RF / C

4512 204 0015.

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SERVICE MANUAL - UNIT

Repl. kit 7E Converter - OPTIMUS RAD / RF / C

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4512 204 0015.

In case there are any questions concerning this manual,
please send this LOPAD via fax to 49/(0)40/5078 2481

File:Repl_kit_7E_Converter_27861_AA_030

List of pages and drawings (LOPAD)

Manual Order No: 4512 984 27861
released: 12/2003

0.5		223 mm	(Rosa Karton)
1			
2			
3...12	(03.0)		
Z1-1	(b/04.0)	A3	Converter R/F
Z2-1	(b/03.0)	A3	Converter R/F

INTRODUCTION AND TECHNICAL DATA

TEXT

DRAWINGS

1. Introduction and technical data

1.1. Purpose of manual

This manual describes the replacement procedure of 7E converter in OPTIMUS RAD / RF / C generators.
The unit is initial delivered ones in Optimus 50 kW generators and twice in Optimus 65 / 80 kW generators with OPTIMUS RAD / RF / C generators from factory pre–installed.
Also delivered as replacement kit in case of failures with the 7E converter in the field.
Due to cost reduction purposes service and factory stock is combinbed in one location and the number of service parts is reduced to one number.

1.2. Item supplied

4512 204 0015. Converter Q

1.3. Compatibility

9890 000 0277. Converter RF
4512 204 0015. Converter Q
4515 204 0016. Converter 2Q
4512 104 7231. Converter Optimus

1.4. Technical data

1.4.1. Mechanical data

Crate / **Box**	**Dimension (mm)**			**Weight (Newton)** (10 N = 1 Kg)
	Length	Width	Height	
Packed	700	520	400	200

1.4.2. Environmental data

	Operation	**Stock** / **Transport**
Temperature in **°Celcius**	0 / + 40	– 40 / + 75
Temperature in **°Celcius** / **Hour**	N / A	N / A
Humidity in % (non–condensing)	5 / 95	5 / 95
Gradient in % / **hour**	N / A	N / A
Vibrations / Shock range in **Hz**	5 – 500	5 – 500
Vibrations / Shock amplitude in **mm**		
Vibrations / Shock acceleration in **g**	0.25 peak	1.0 peak
Shock acceleration in **g**	5 peak	30 peak
Shock pulse duration in **msec**	11	11
Air pressure in **Hecto–pascal**	700 / 1100	700 / 1100

Acoustic noise level : 35 dBA
Air cooling : N / A
EMC : IEC 950

1.4.3. Electrical data

Equipment related:

Power required	:	86 kVA, Peak load max for 100ms	
Nominal voltages	:	3x 400 VAC	
Nominal current	:	125 A_{max}	
Nominal frequency	:	50 Hz / 60 Hz	
Heat emission	:		
standby	:	< 20 W	(1 Joule/sec = 1 Watt)
in operation	:	200 W; Optimus 65 / 80 kW 400 W; Optimus 50 kW	max. for Exposure time

1.4.4. Transport data

N / A

1.4.5. Tool

Standard Tool Set :

1.5. Safety information

The general legal and factory safety recommendations for this X-ray equipment and the following recommendations must be strictly observed!

Start of operation and maintenance work and, especially, electrical work must only be executed by authorized persons.

Warning!

The system/component must be switched OFF during replacement work. Any X-ray unit produces ionizing radiation which may be harmful if not properly controlled. Therefore, it is recommended that this equipment be operated in accordance with the guidelines set down by the national council on radiation protection.

2. Replacements

2.1. Replacement procedure of FRU

2.1.1. FRU Converter Q / 2Q

Tools required : Standard tool set
Time/manpower : 1hour / 1 engineer
Preconditions : Disconnect the delivered wires from the new unit

- Open the delivery box
- Take the inside box out and put it on the floor take care, the converter weight is approximately 18kg / 180kN
- Open the box and put the converter on the floor
- Open the cover plate

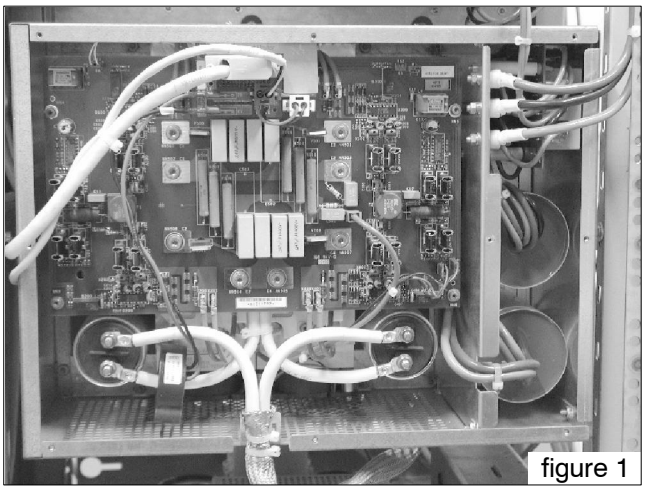


figure 1

- Disconnect the wires from the new converter
  The are not necessary, use the old cables and wires from the generator.
- Power cable **(1)** C3:1; C13:1
- Mains supply cable **(2)** X1101; X1102; X1103
- Discharge wire **(3)** EQ200 : X11 & X13

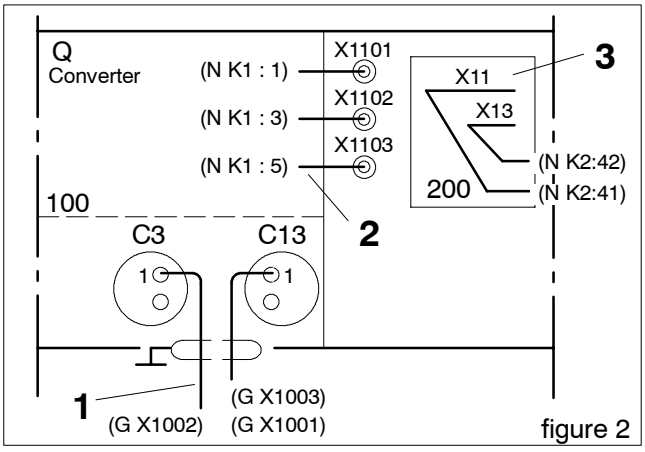


figure 2

Replacement procedure:

- Switch the generator off
- Open the cabinet
- **Switch ENF1 “OFF”**
- Open the converter cover of the converter to be replaced, Q or 2Q
- Disconnect all wires and cables

- Remove the complete unit from generator cabinet, remove the 4 fixing screws

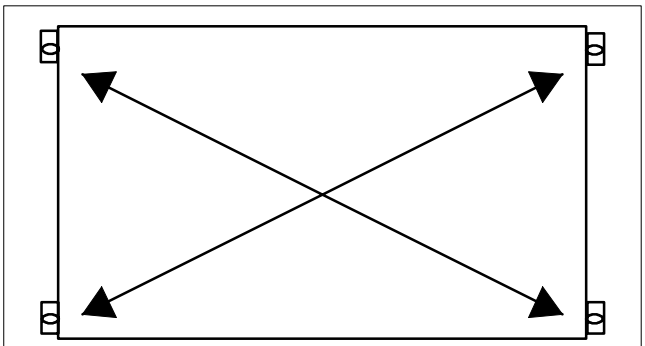


figure 3

- Install the new unit into the cabinet, fix the unit with 4 screws.
- Connect all wires and cables according figure 2 or drawing Z2–1
- Close the unit cover
- Push back the generator into original position
- **Switch ENF1 "ON"**
- Close cabinet cover
- Test all applicable functions.

3. Adjustments

3.1. General information

The actual value of the set kV must be attained at least after2ms. At kV rise phase there must be neither kV break – in nor a kV overshoot.The Factor Duty Cycle is based on an adapted tube and determines at local mains voltage and mains resistance conditions:

- the kV rise phase
  and
- the kV behavior during the exposure in falling load technique as it takes into account the tolerances of the following FRUs (**F**ield **R**eplaceable **U**nits):

  1. PCB EZ 130 ******
     kV_control_3 = 50kW 1 converter 4512 108 0908x
     kV_control_4 = 65/80kW 2 converters 4512 108 0910x
  2. A complete power converter unit Q ******
     kV_power PCB(s) Q100 (part of the power converter unit)
     IGBT transistors (part of the power converter unit)
  3. Resonance capacitors (part of the power converter unit) ******
  4. High tension transformer ******

An exchange of one of the ****** marked parts requires a realignment of the Factor Duty Cycle.

The Factor Duty Cycle is stored in the memory of PCB CU EZ139. If the CU has to be replaced the CU complete backup can be reloaded (with the actual factor) to the NVRAM memory or the Factor Duty Cyclemust berealigned.

Refer to figure

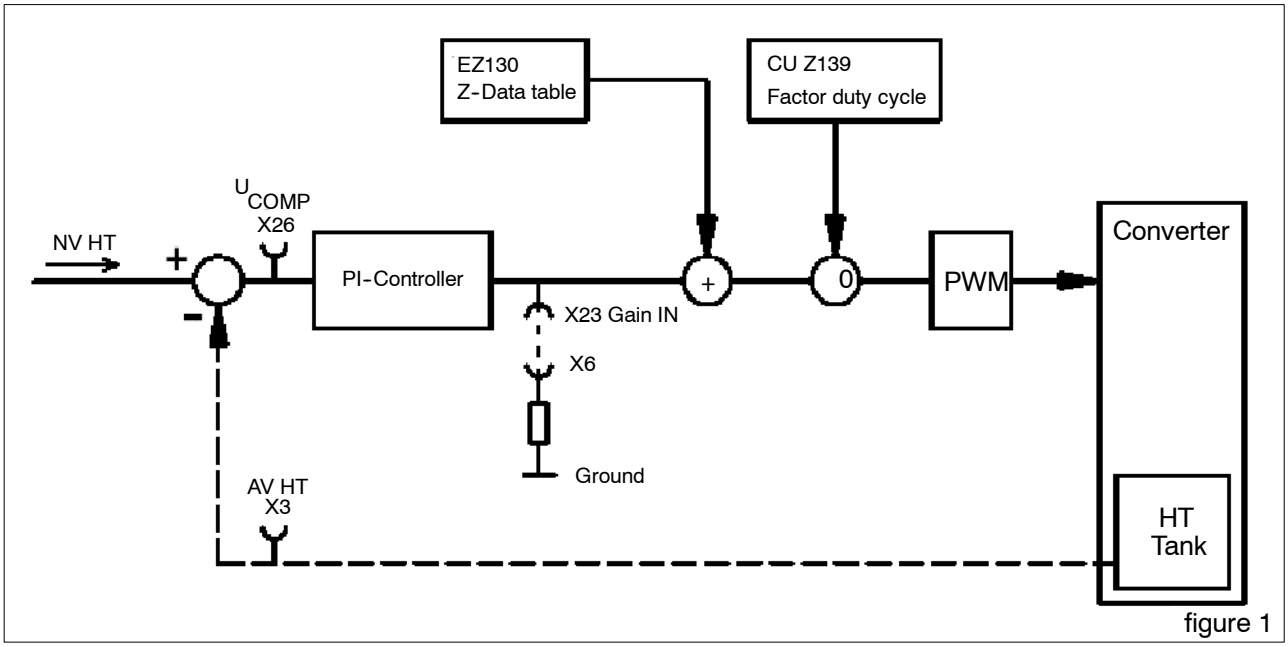


figure 1

During alignment this Factor Duty Cycle must be entered via XRG SCOPE or AGenT. The influence of this factor as a correction value for the Z-Data Table is monitored as the U_{COMP} signal, since the PI-Controller is deactivated by the grounded *GAIN_IN* signal.

3.2. Connecting and setting the scope

For connections see figure 2:

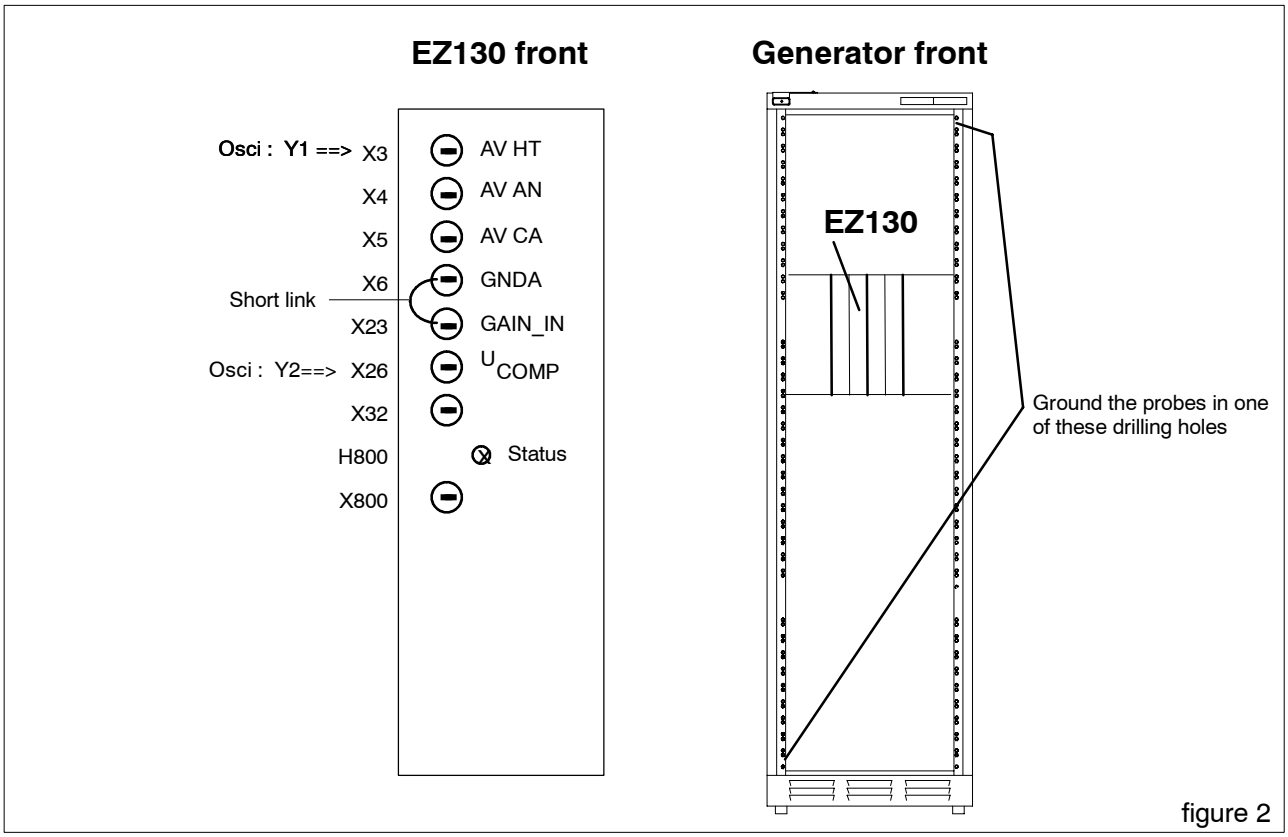


figure 2

Channel 1 = EZ130 X3 -----> *AV HT* -----> 20kV/V -----> 1V/div ----> Zero--line at bottom of screen
Probe GND = one of the drilling holes at the front cabinet chassis

Channel 2 = EZ130 X26 ------> *UCOMP* ------> 1V/div ------> Zero--line 2 div from bottom of screen
Probe GND = one of the drilling holes at the front cabinet chassis

Trigger = external (preferred) ------> *CTRL_X_C/* ------> backpanel EZX74 / negative slope
or = internal channel 1 ------> *AV HT* ------> EZ130 X3 / positive slope at +3V
Probe GND = one of the drilling holes at the front cabinet chassis

Time base = 5 or 10ms/div ------> trigger delay --1div

Note
A digital scope should not have any other ground connection than the ground of the 3 probes at the drilling holes at the front generator chassis.A mains-driven scope must be isolated from earth potential, otherwise it might display artefacts.

3.3. Deactivating the kV controller

- Connect EZ130 X23 *GAIN_IN* and X6 *GNDA* with a short link (use a short wire).

Caution!
This alignment requires exposures with high kV.Be sure the tube has been warmed up before.

3.4. Setting of exposure data

a) Set 141kV in case of

65/80kW
the tube limit (of at least one tube) is 150kV perform this adjustment at the tube which has the highest kV limit programmed.

b) Set 125kV in case of

50kW
and
65/80kW if the programmed application limit of the tube limit is 125kV.

Note
Any tube arcing during this adjustment requires the execution of the tube conditioning next as described in section 2 "INSTALLATION".Disconnect the short link between X23 and X6.Start over this adjustment from chapter 2.3 onwards if the tube conditioning was successful.

Set kV and mA values according to the programmed tube limits:

a) **141kV:** 200mA at kV_4 (65/80kW)

b) **125kV:** 100mA at kV_3 (50kW)
200mA at kV_4 (65/80kW)

Set exposure time: 40ms

3.5. Adjustment of the ”factor for duty cycle”

XRGSCOPE

- Adjust the Factor Duty Cycle via service
- software XRGSCOPE by measuring U_{COMP}
- with the scope.

- Connect the service PC and start XRGSCOPE:

XRGSCOPE
SELECT UNIT ----> FU--kV ----> ADJUST----> IGBT Pulse Width Correction ---->Factor Duty Cycle

AGenT

- Adjust the Factor Duty Cycle via service
- software AGenT by measuring UCOMP with
- the scope.

- Connect the service PC and start AGenT:

SELECT --> Program --> FU kV IGBT Pulse Width correction

- Set the starting value Factor Duty Cycle to **1.00**:

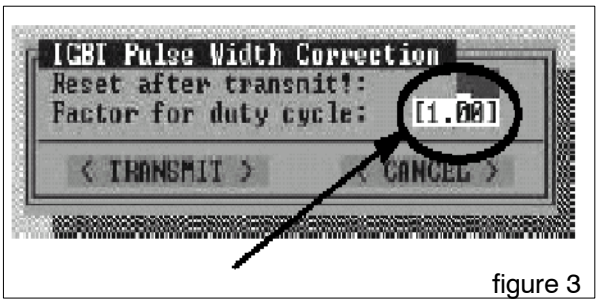
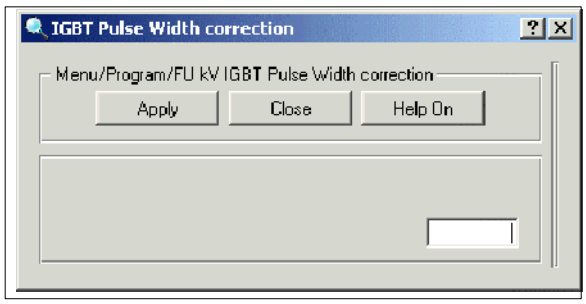


figure 3



If the U_{COMP} value does not match the requirements type in another Factor Duty Cycle value,<TRANSMIT> the screen and push the active RGDV button to get the new value validated.

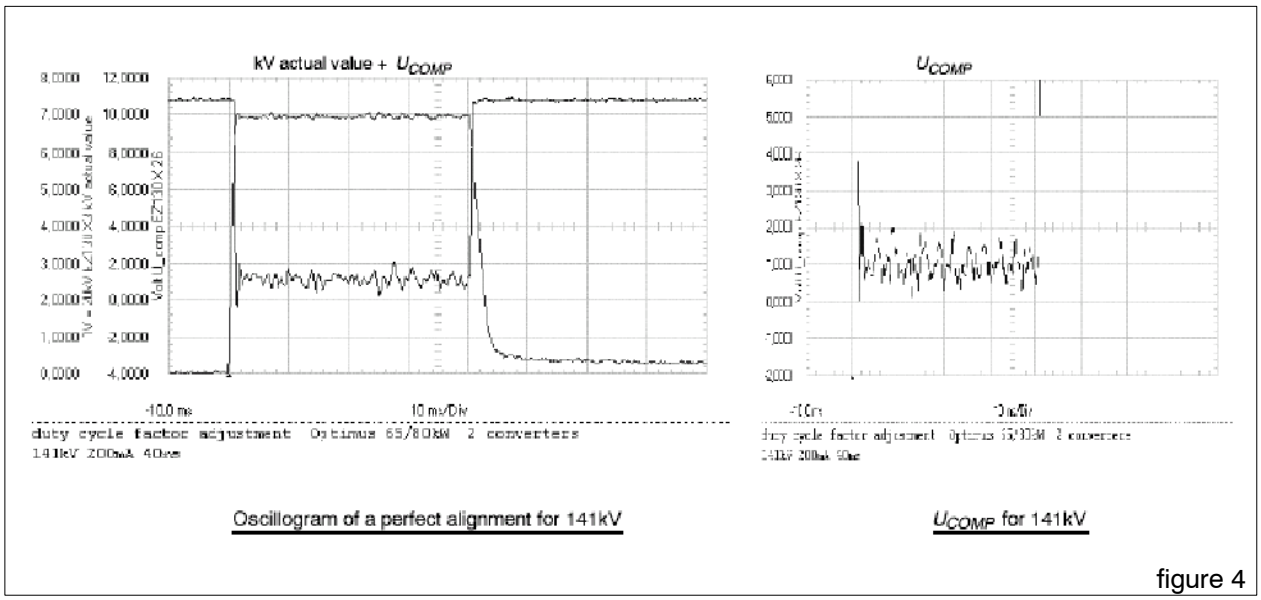
If the U_{COMP} value does not match the requirements type in another Factor Duty Cycle value,<Apply> the screen and push the active RGDV button to get the new value validated.

- Switch an exposure.

The values are measured in the stationary condition. The transient behavior at the beginning of the exposure is not taken into account.

Result:

In standby the U_{COMP} value is at about +11V, during exposure the mean value U_{COMP} must be as givenin table 1 or 2, refer to figure 4:



Oscillogram of a perfect alignment for 141kV

U_{COMP} for 141kV

figure 4

a) 141kV setting (65/80kW only)

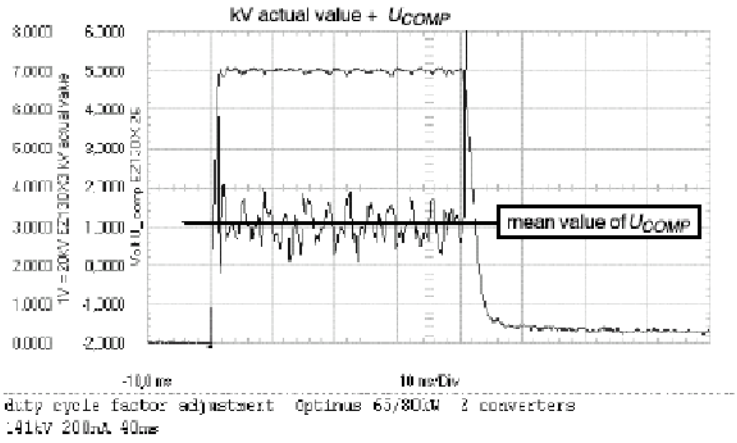
- Read the mean value of U_{COMP} for 141kV (see scope figure 4 or 5), correct the Factor Duty Cycle till U_{COMP} meets the required reference of +1V.

kV setpoint	mA setpoint	PCB type	U_{comp}	Tolerance	kV peak of AV HT	Factor Duty Cycles:	Date:
141kV	200mA	PCB kV_control 4 :	+1V	±0.5V	138kV		

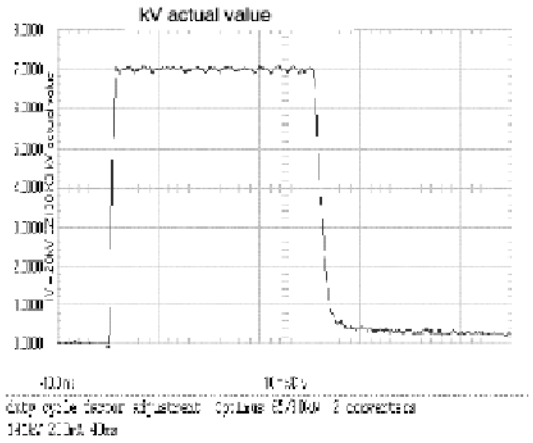
Table 1: Factor Duty Cycle, settings 141kV (150kV limit)

PCB kV_control 4:

- If the mean value of *UCOMP* is: > +1.5V **increase** the Factor Duty Cycle in steps of 0.01
  < +0.5V **decrease** the Factor Duty Cycle in steps of 0.01
- Check also the kV peak value *AV HT* (not the overshoot), it must be **138kV** for **141kV** setpoint. (see scope figure 5)
- Remove short link EZ130 X23 *GAIN_IN*.
- Record the findings in table1.



Optimus 80kW with 141kV, U_{COMP} = +1V



AV HT with overshoot

figure 5

4. Acceptance

N / A

5. Parts disposal

Since the unit is a repairable spare part put the old unit back into the delivery boxes. Put also the not used wires and cables into the box and send it back via normal logistic return procedure.

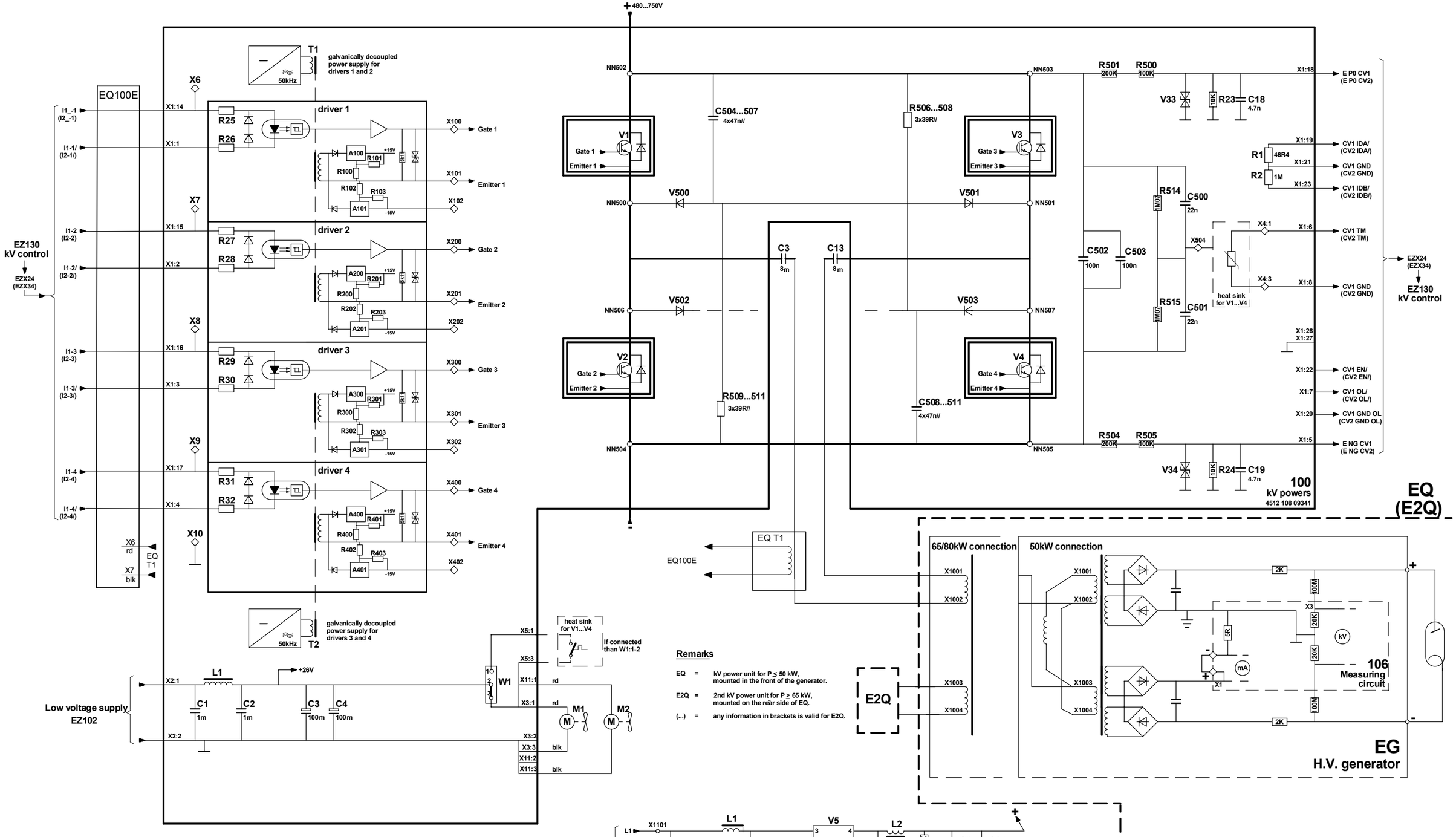
6. Documentation

File this document into generator book close to the Converter R/F manual.

7. Z. Drawings

Z1-1

Z2-1

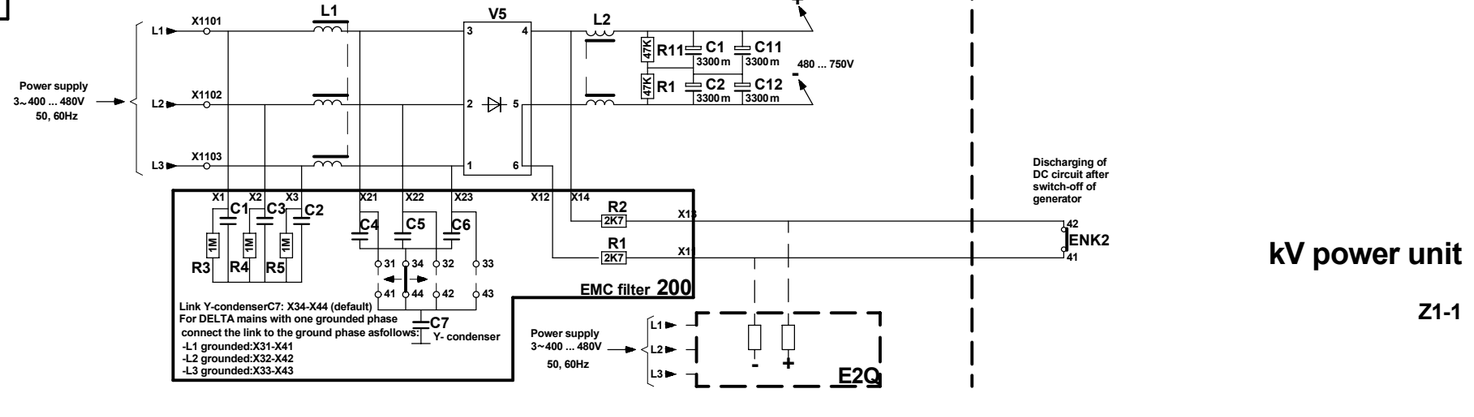


Remarks

EQ = kV power unit for P ≤ 50 kW, mounted in the front of the generator.

E2Q = 2nd kV power unit for P > 65 kW, mounted on the rear side of EQ.

(...) = any information in brackets is valid for E2Q.



Mnemonics

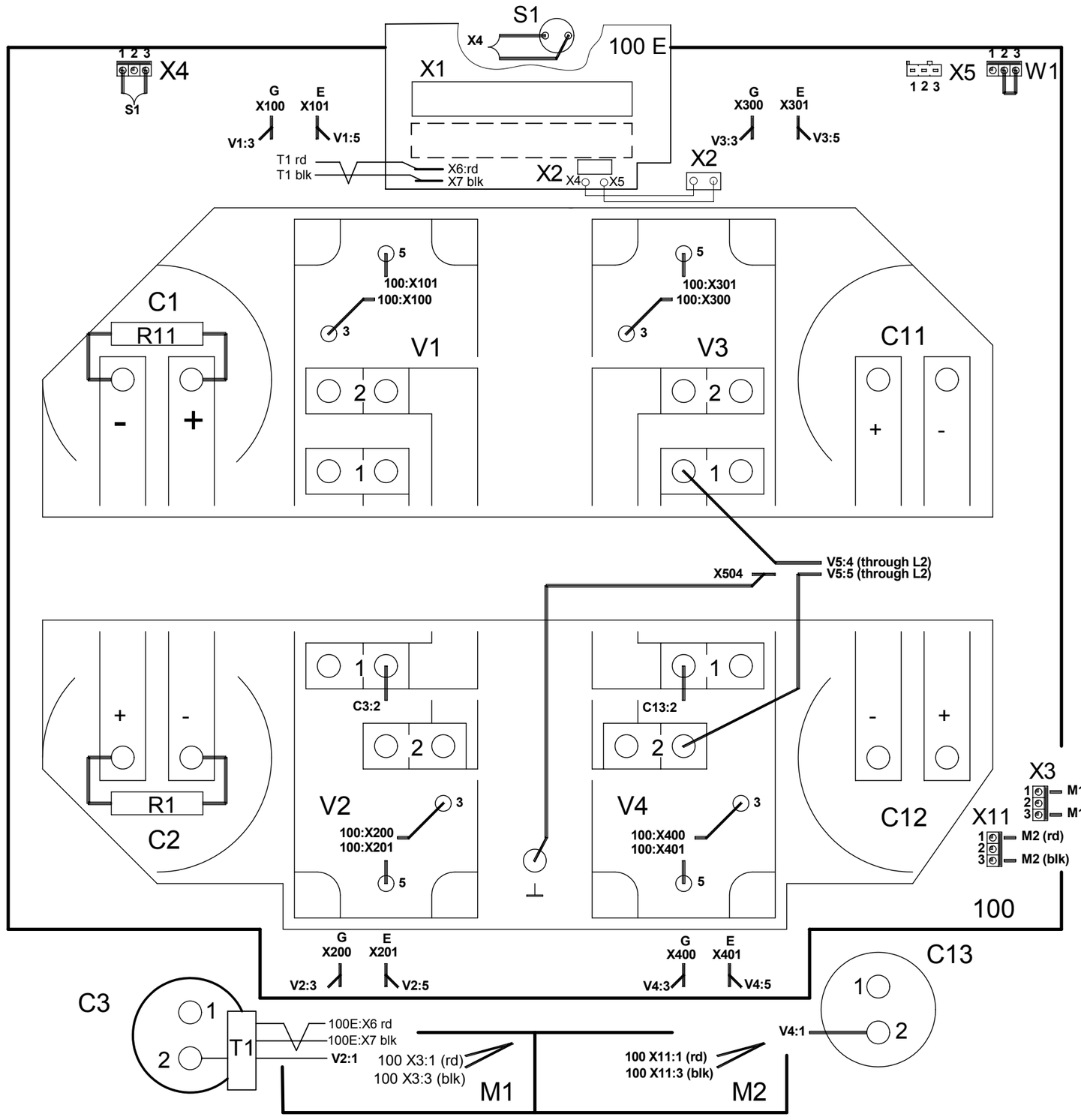
E NG CV1	E value converter power part 1 DC supply negative	CV1 IDA/	converter power part 1 identification	I1 3 I1 3/	IGBT3 power part 1
E NG CV2	" " " " " 2 " " "	CV1 IDB/	" " " 1 "		
E PO CV1	E value converter power part 1 DC supply positive	CV2 IDA/	converter power part 2 identification	I1 4 I1 4/	IGBT4 power part 1
E PO CV2	" " " " " 2 " " "	CV2 IDB/	" " " 2 "		
CV1 EN/	converter power part 1 enable	CV1 OL/	converter power part 1 overload	I2 1 I2 1/	IGBT1 power part 2
CV2 EN/	" " " 2 "	CV2 OL/	" " " 2 "		
CV1 GND	converter power part 1 ground	CV1 TM	converter power part 1 temperature	I2 2 I2 2/	IGBT2 power part 2
CV2 GND	" " " 2 "	CV2 TM	" " " 2 "		
CV1 GND OL	converter power part 1 ground overload	I1 1 I1 1/	IGBT1 power part 1	I2 3 I2 3/	IGBT3 power part 2
CV2 GND OL	" " " 2 " "	I1 2 I2 2/	IGBT2 power part 1	I2 4 I2 4/	IGBT4 power part 2

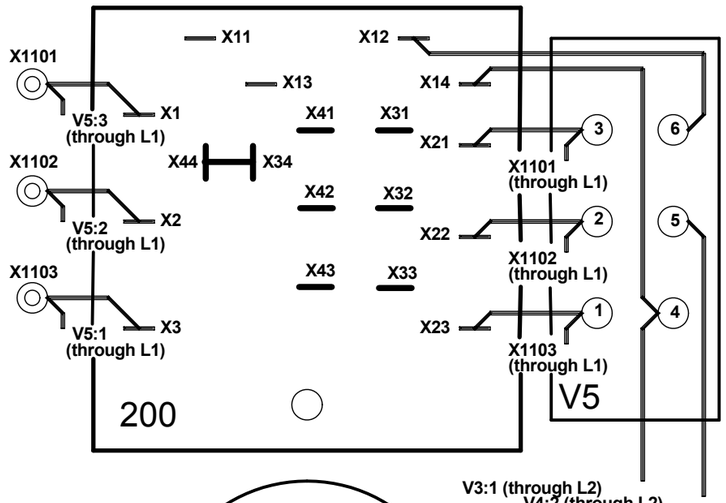
Converter R/F (b/04.0)

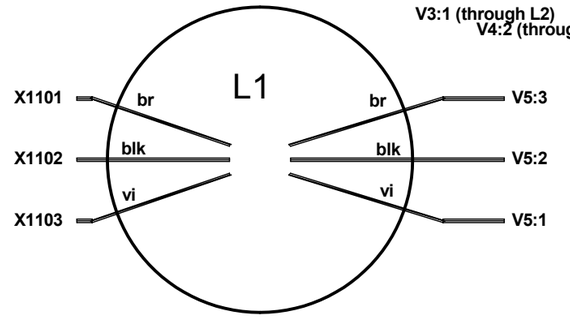
A1/A3 04-01-23 Schr.

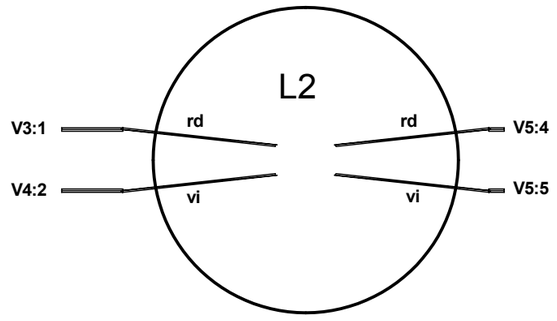
kV power unit

Z1-1









Q/2Q
kV power unit
4512 104 7231.

A3/A3 03-12-09 Schr.